Changing California Wildfire

25 February 2019
Sacramento, CA

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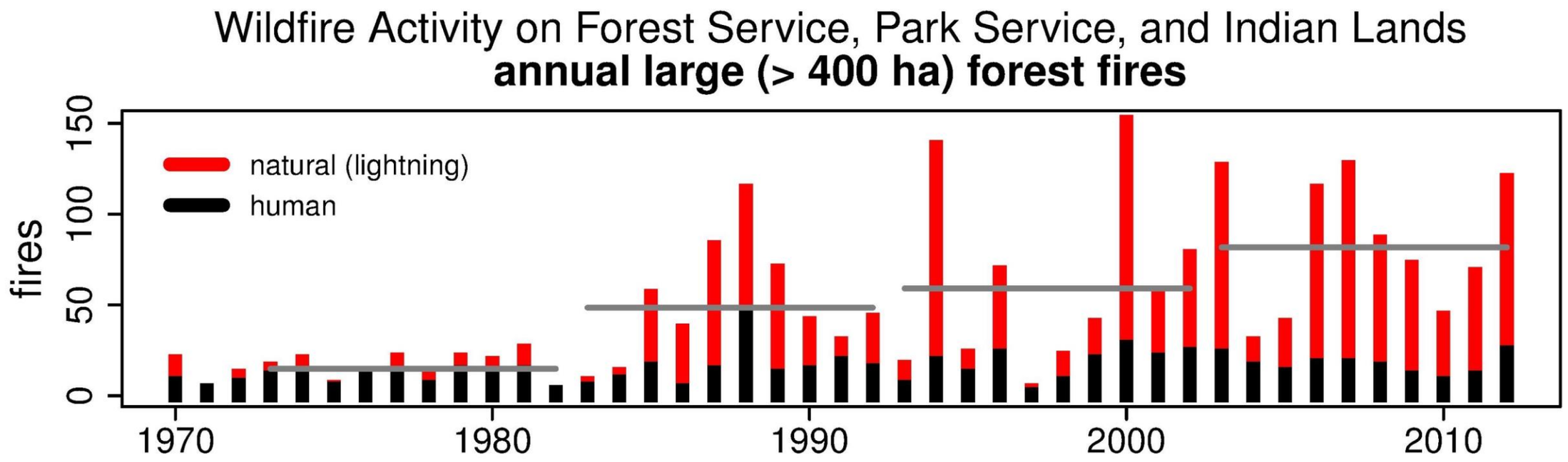
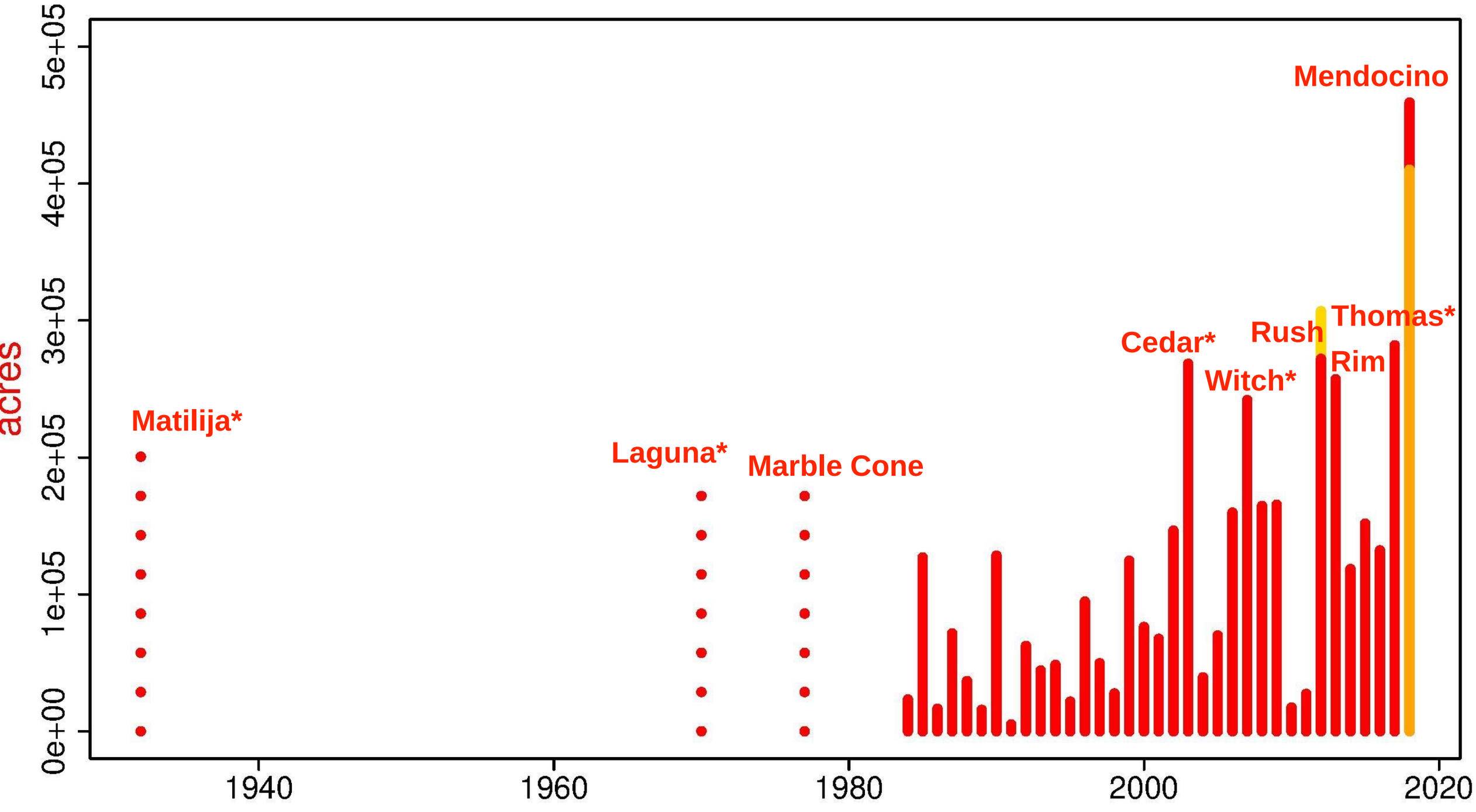
Management of Complex Systems
Ernest and Julio Gallo Program
UC Merced

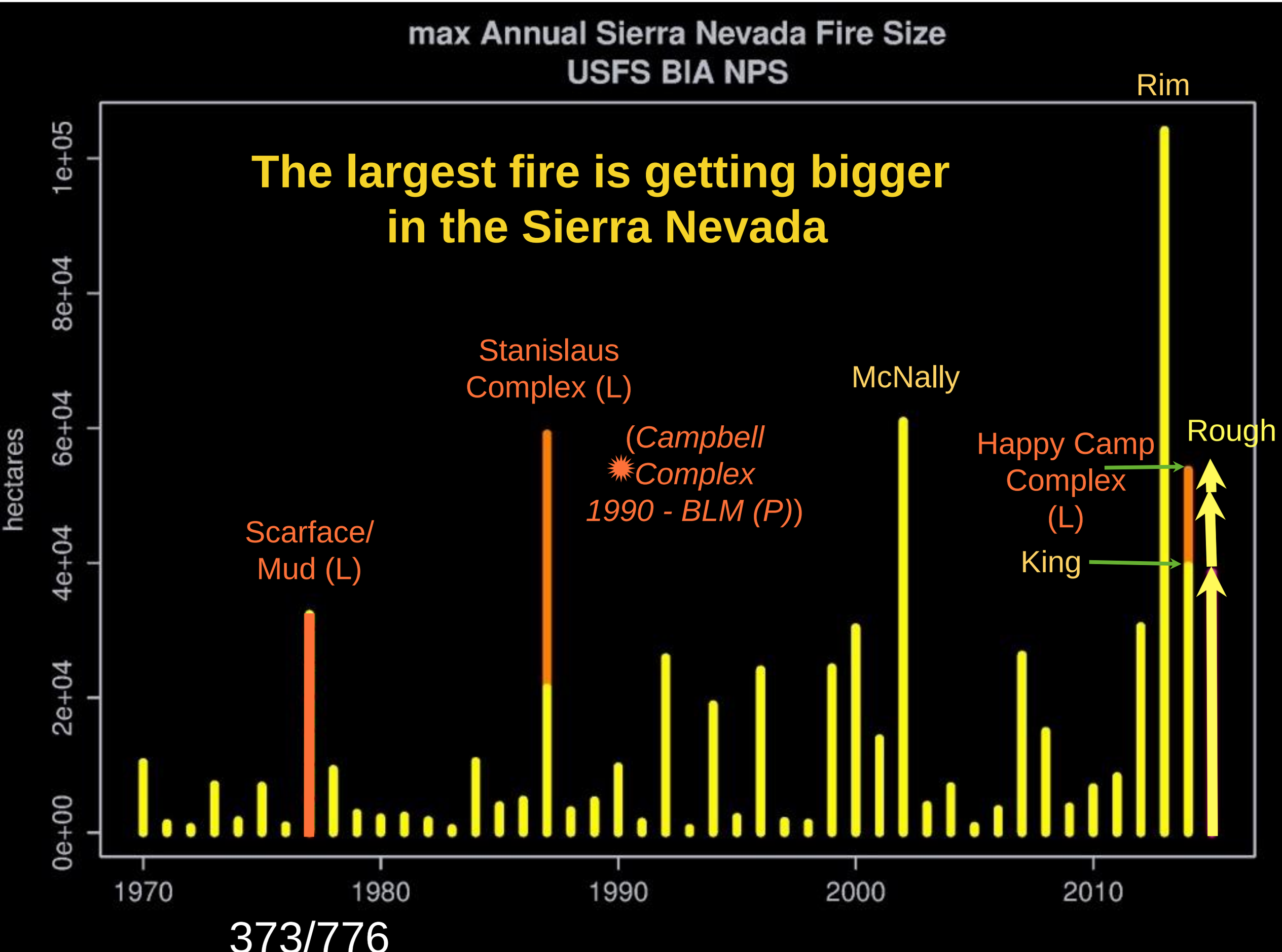
Detwiler Fire 2017
Mariposa, CA

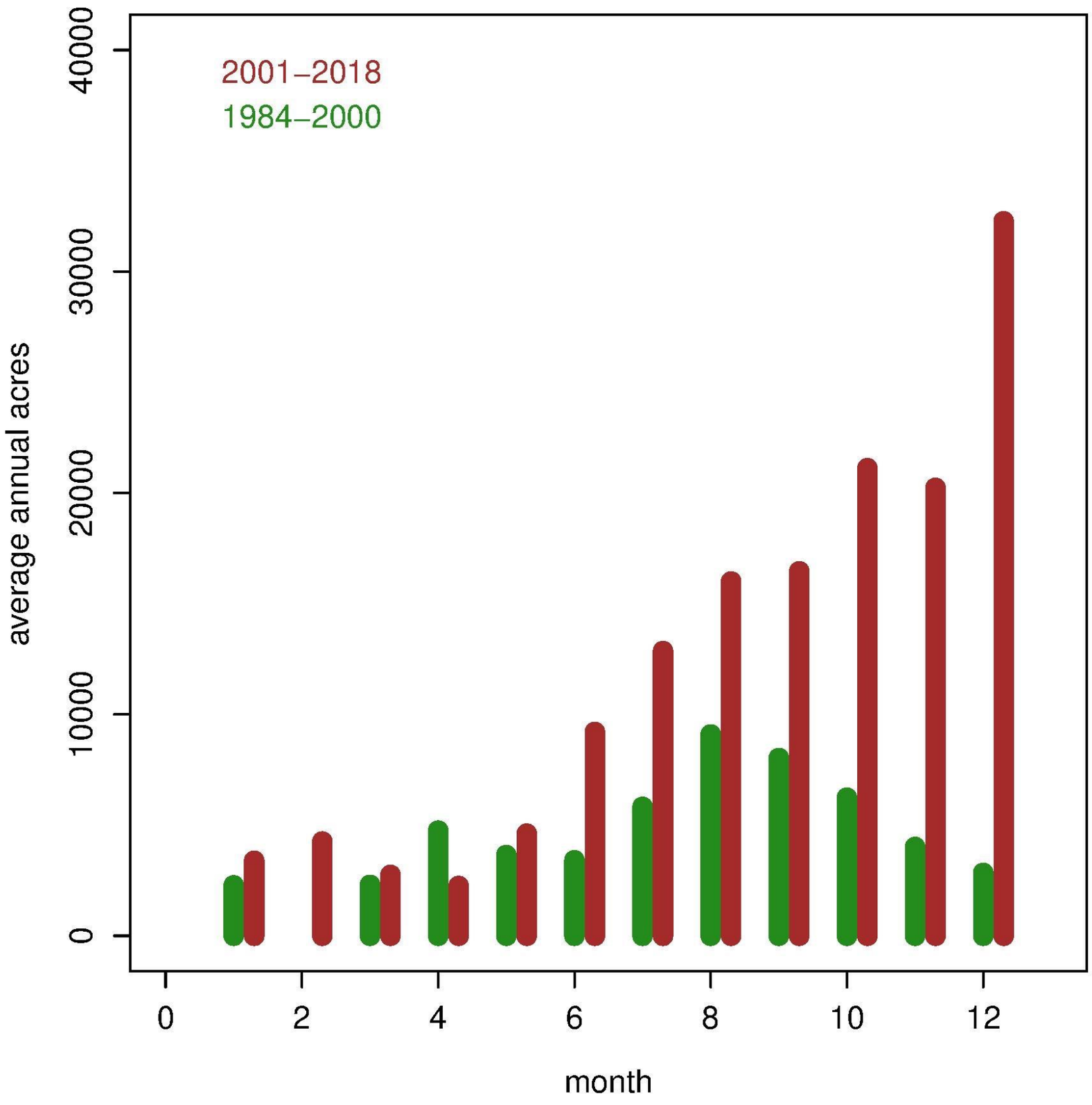


Westerling 2016,
Phil. Trans. Royal Soc. B

California maximum annual fire size

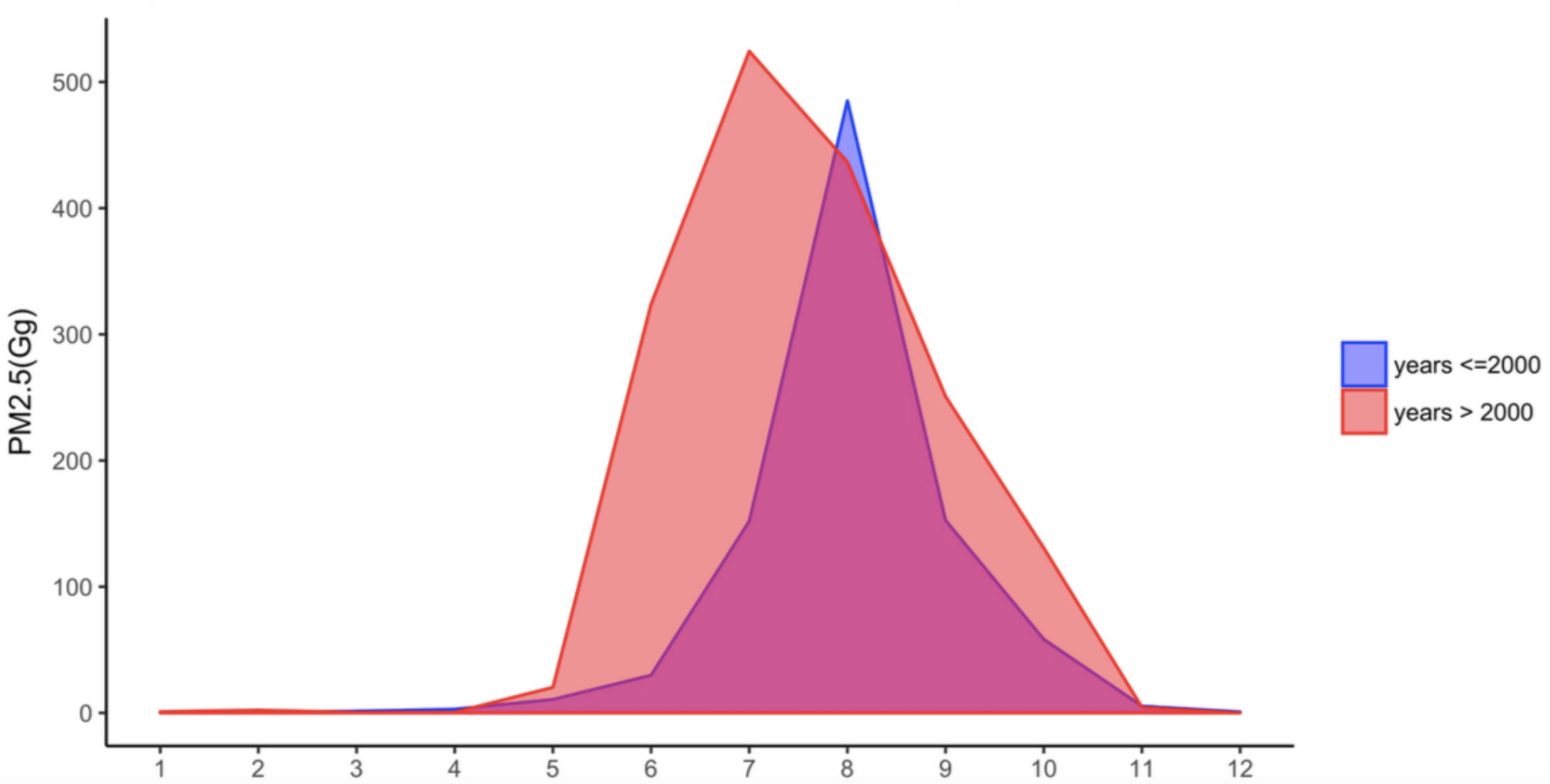


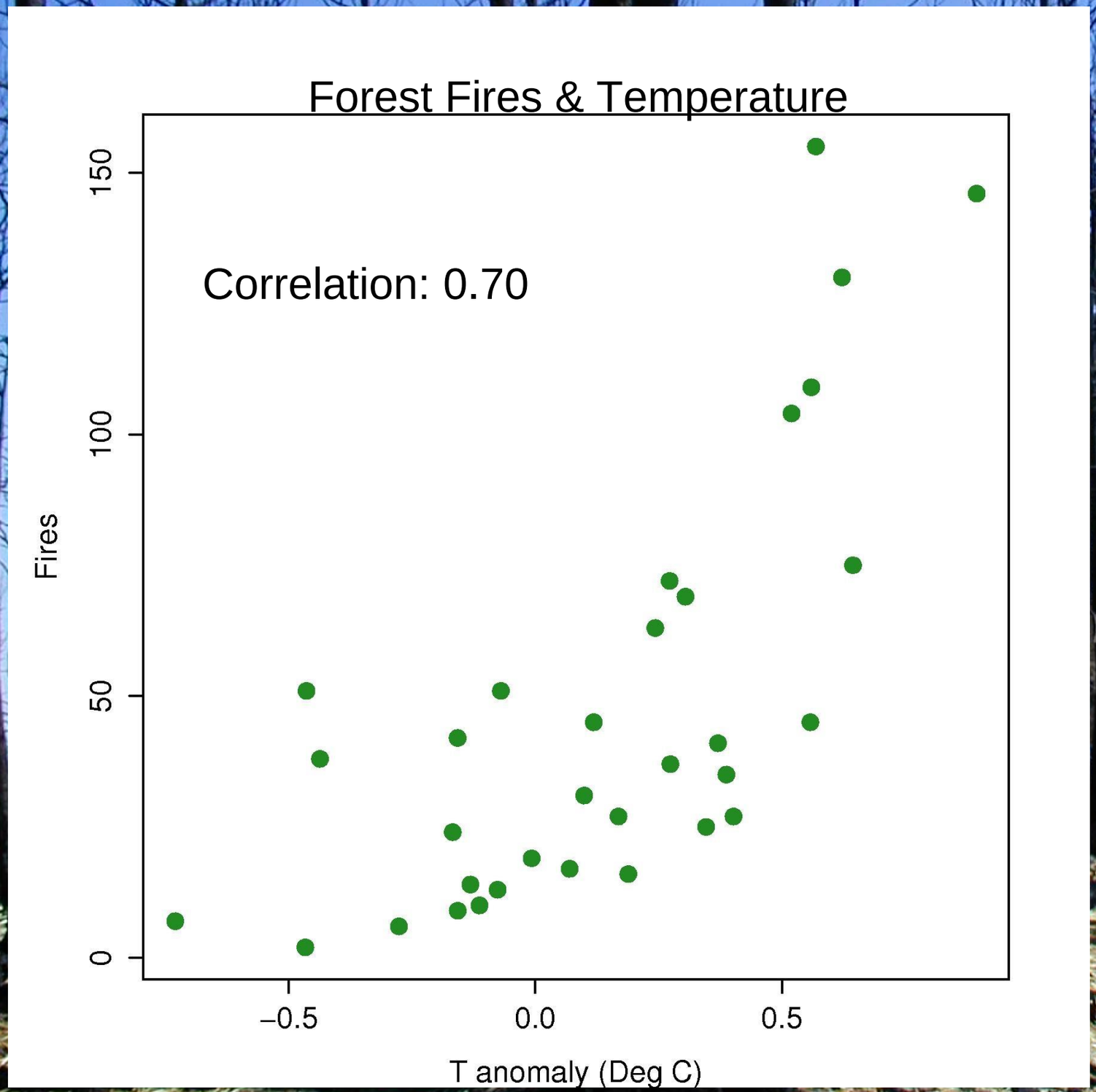

max Annual Sierra Nevada Fire Size
USFS BIA NPS
The largest fire is getting bigger
in the Sierra Nevada
hectares
0e+00
2e+04
4e+04
6e+04
8e+04
1e+05
1970
1980
1990
2000
2010
Rim
Stanislaus
Complex (L)
(Campbell
Complex
1990 - BLM (P))
McNally
Happy Camp
Complex
(L)
Rough
King
Scarface/
Mud (L)


shifting fire season: area burned
2001–2018
1984–2000
average annual acres
0
10000
20000
30000
40000
0
2
4
6
8
10
12
month

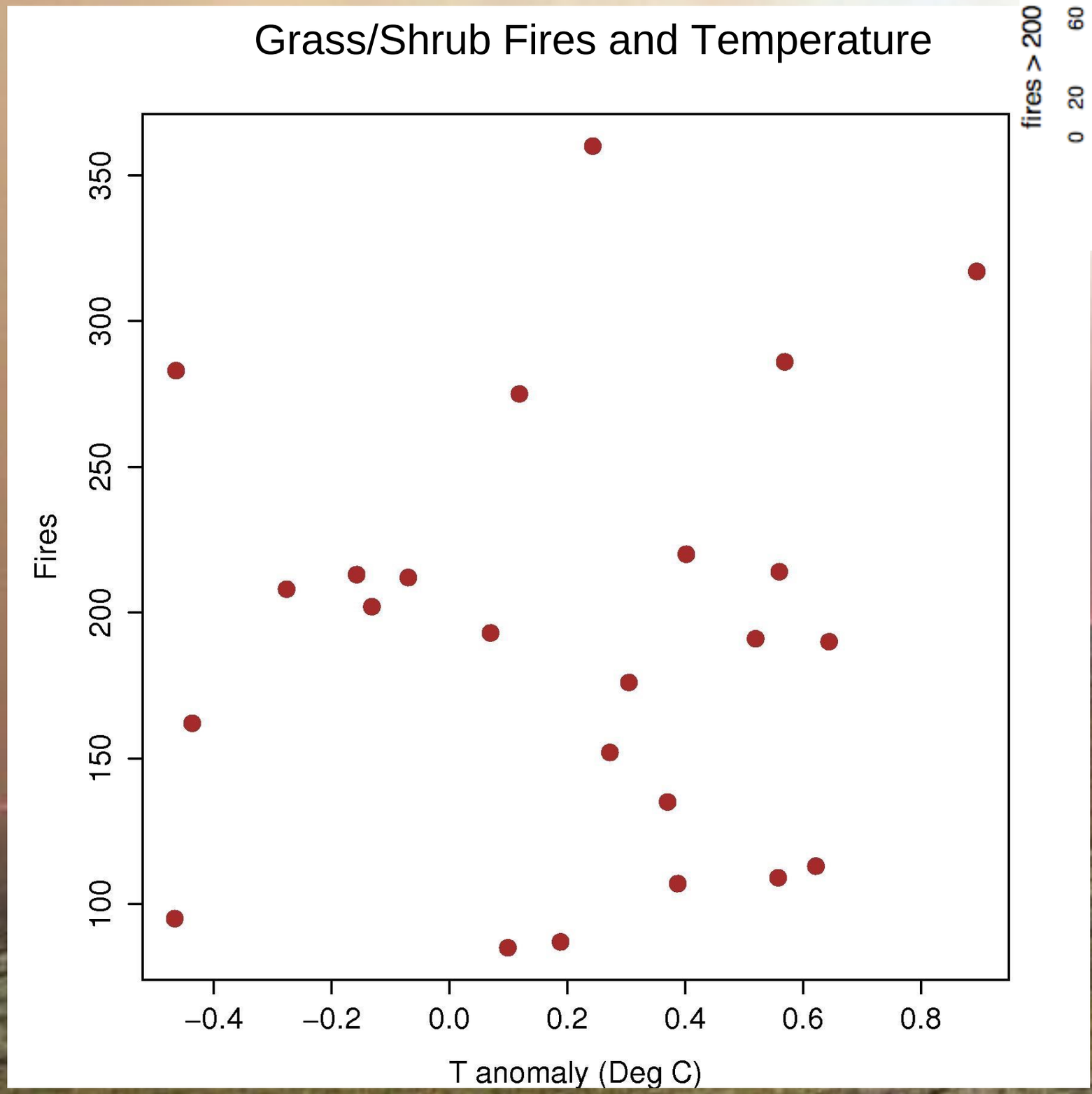
California Wildfire Emissions - ***through 2016***

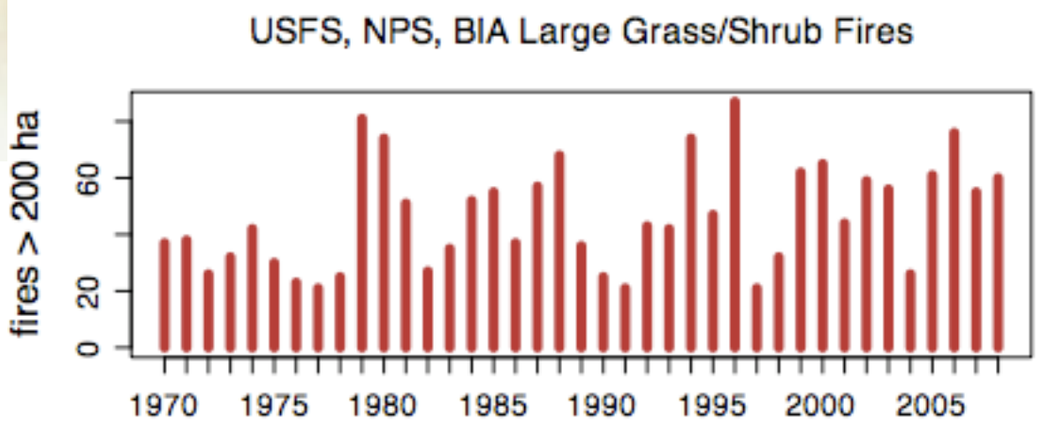
Since the 21st century, there has been an earlier and longer wildfire emission season





Westerling 2009: "Wildfires," in Climate Change Science and Policy, Schneider, Mastrandrea, Rosencranz, Kuntz-Duriseti Eds., Island Press.





Correlation: 0.08

***Westerling** 2009: "Wildfires," in **Climate Change Science and Policy,** Schneider, Mastrandrea, Rosencranz, Kuntz-Duriseti Eds., Island Press.*

Warmer years were correlated with drier years

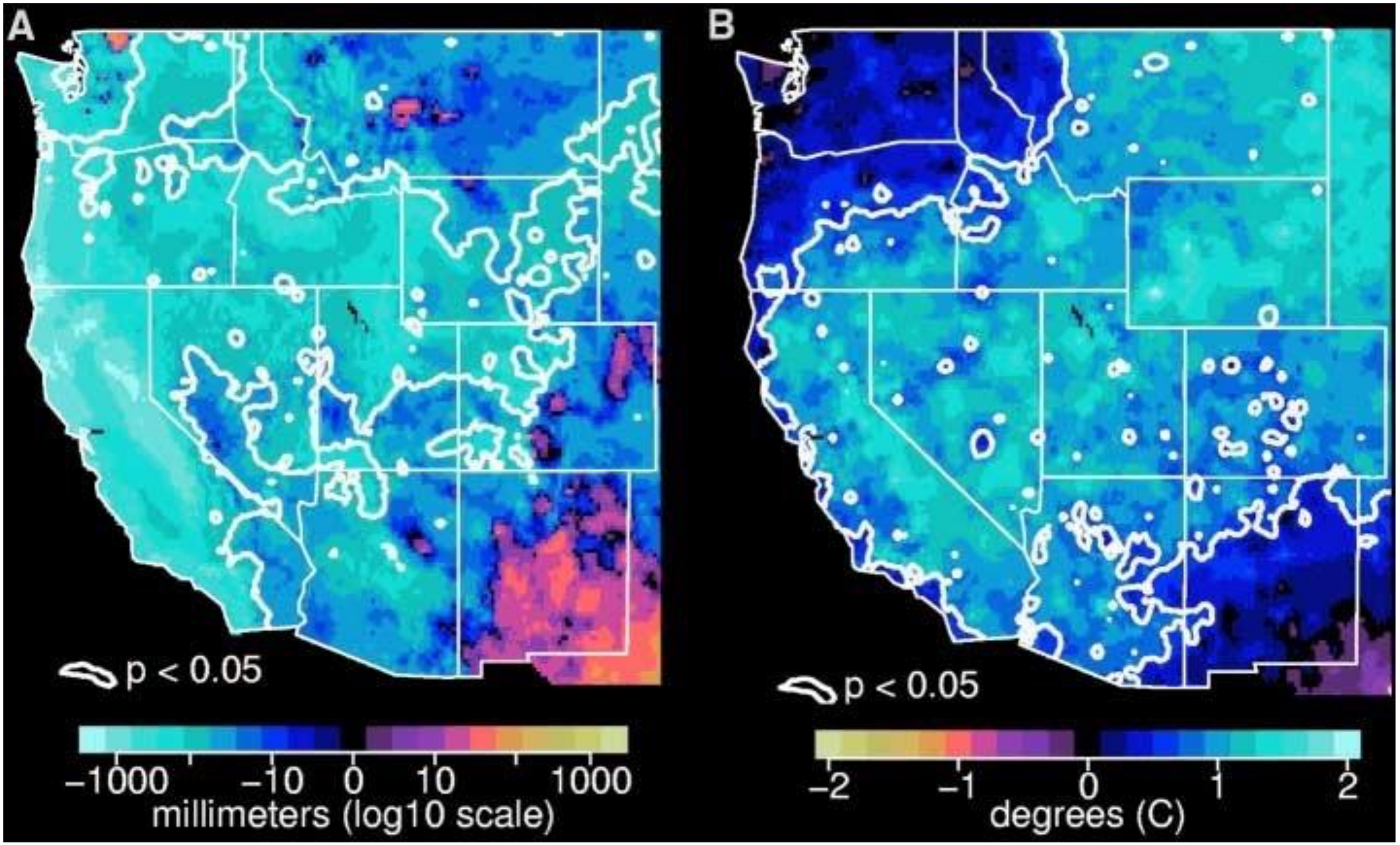
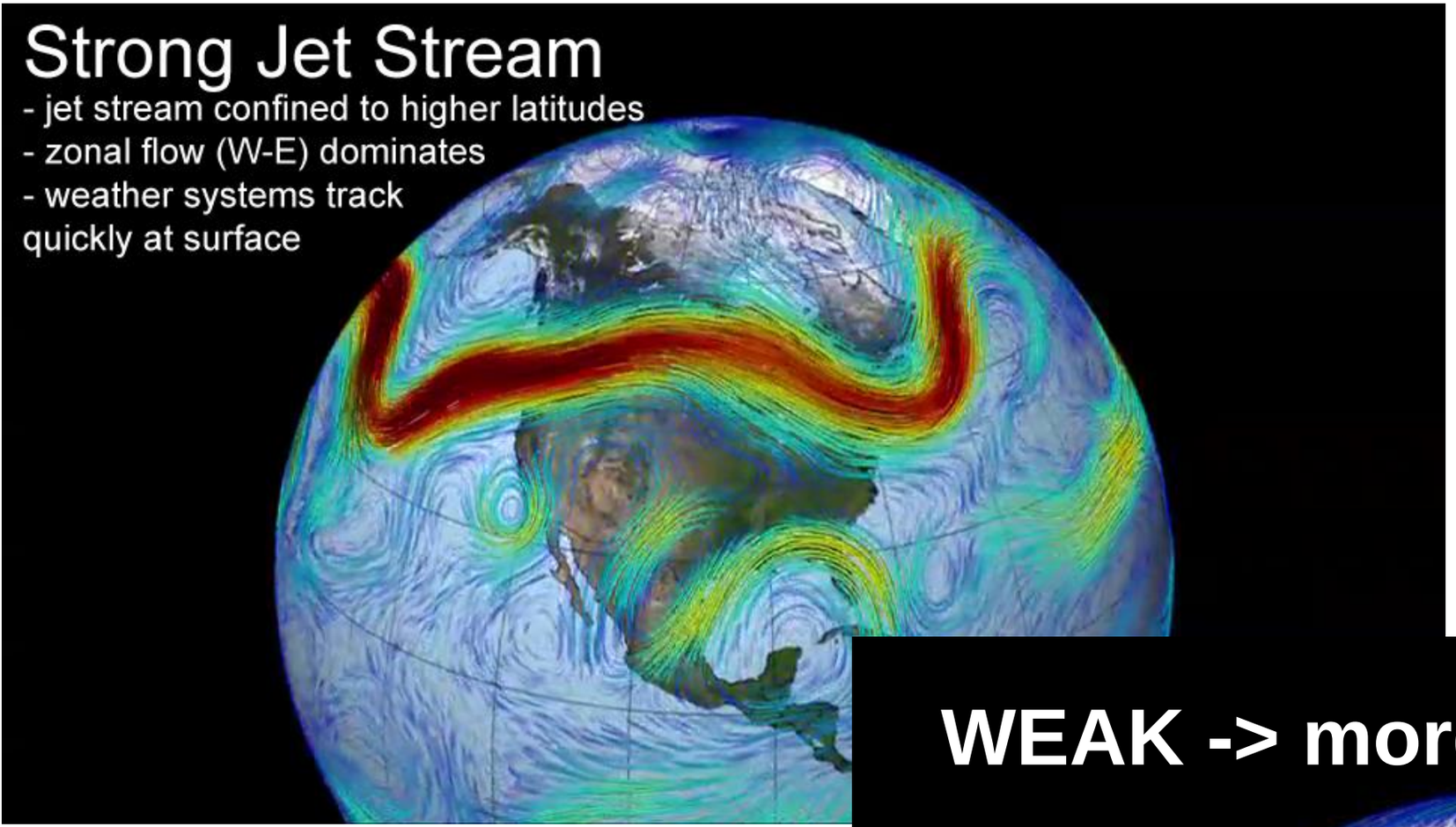
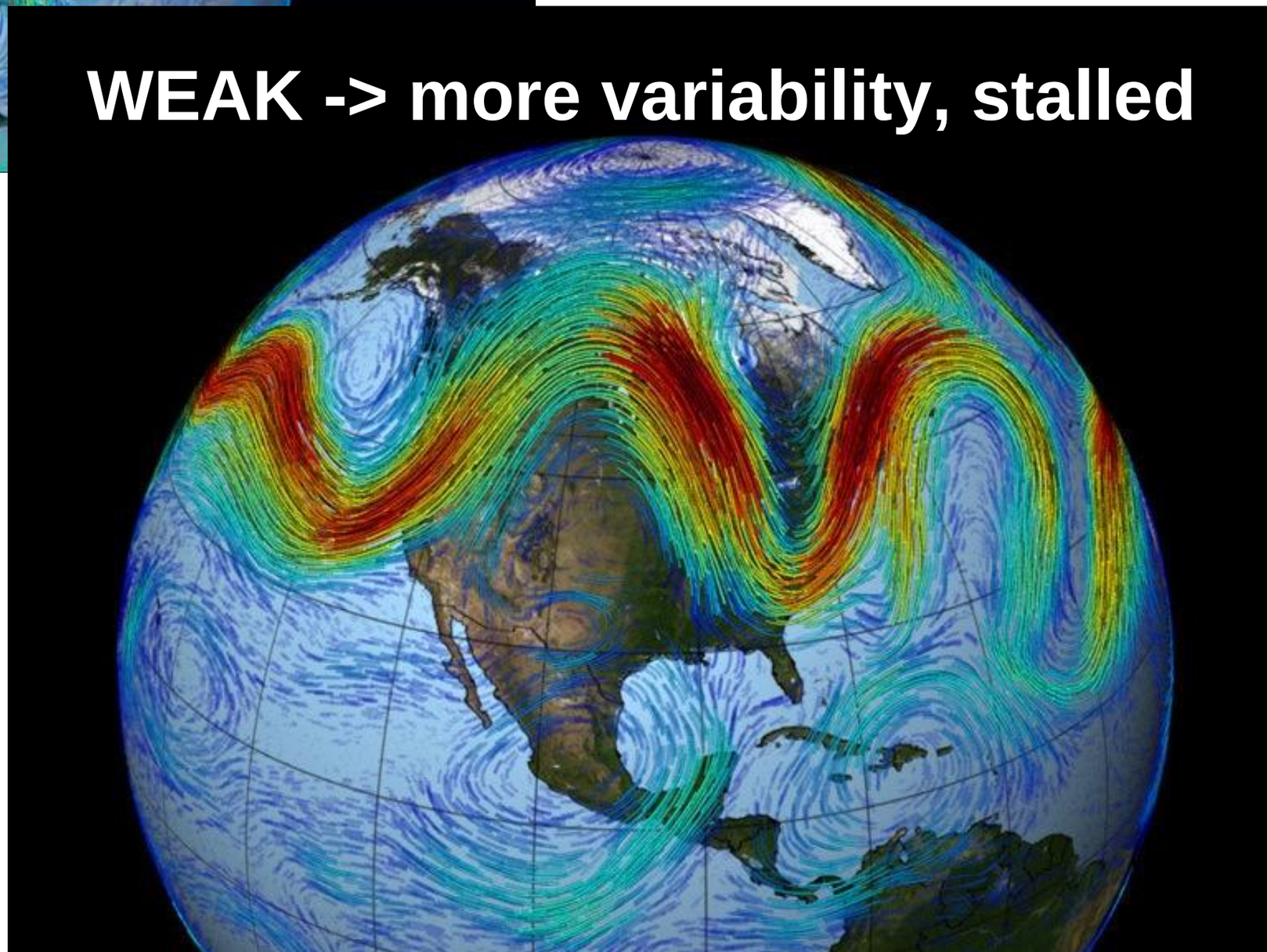


Fig. 3. Average difference between early and late snowmelt years in average precipitation from October through May (A) and average temperature from March through August (B). Contours enclose regions in

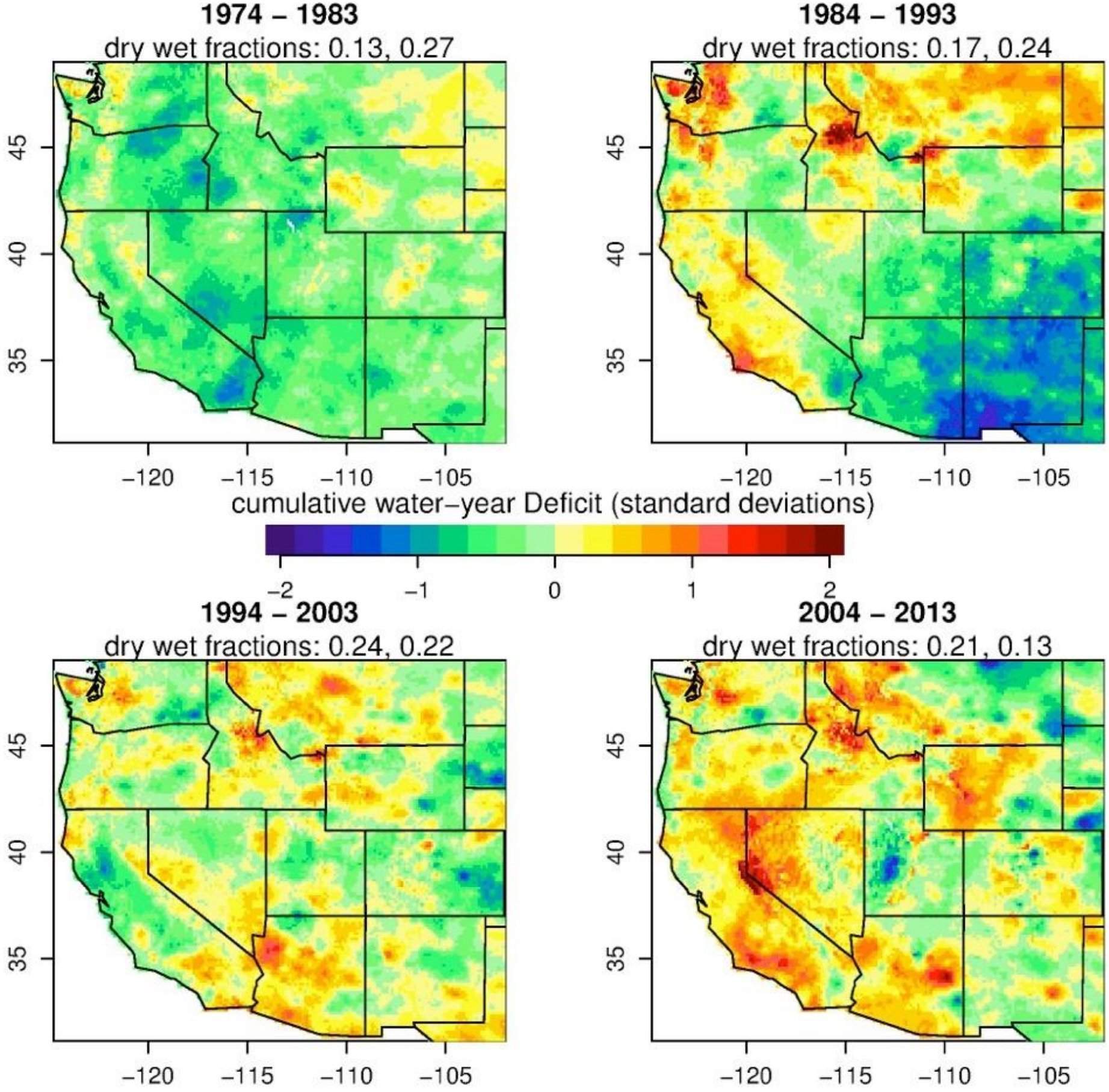


Precipitation is becoming more variable…

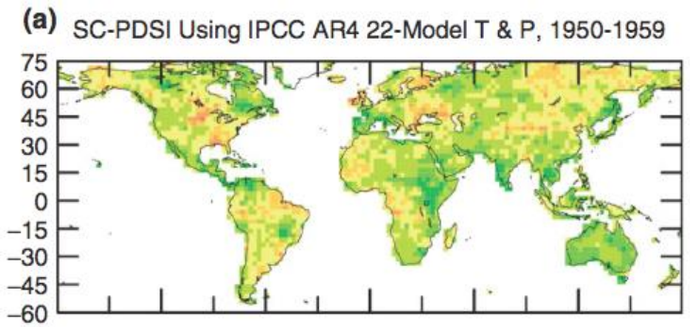
as the pole warms faster than the equator, the jet stream slows and weather patters become more persistent

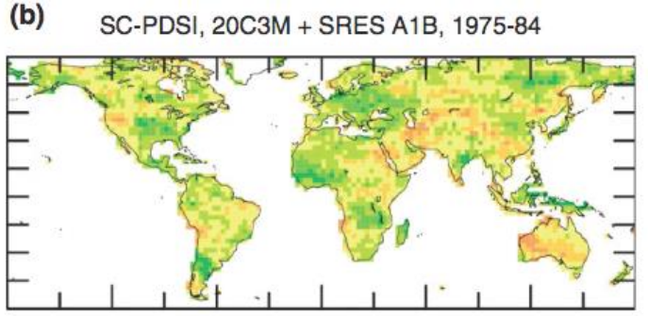


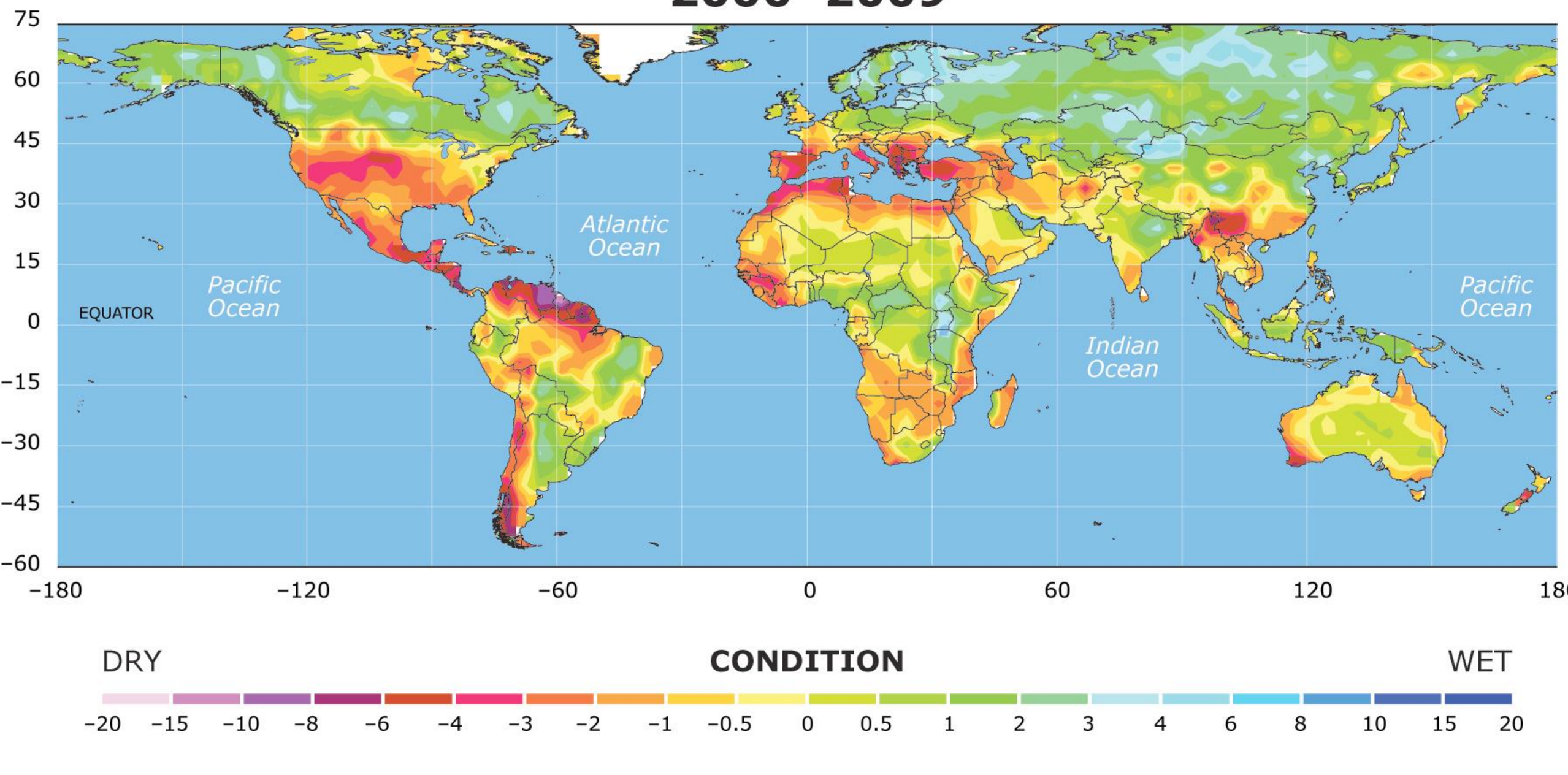
The region is drying out



Drying projected for early 21st C



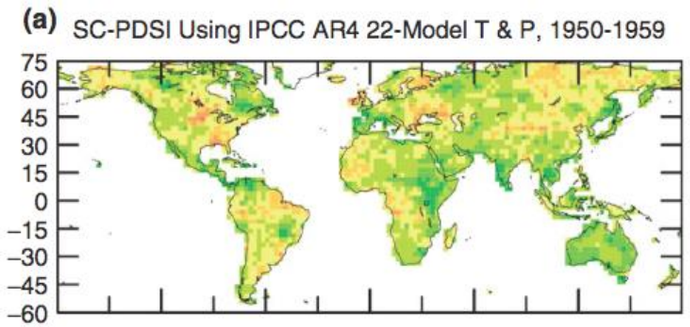


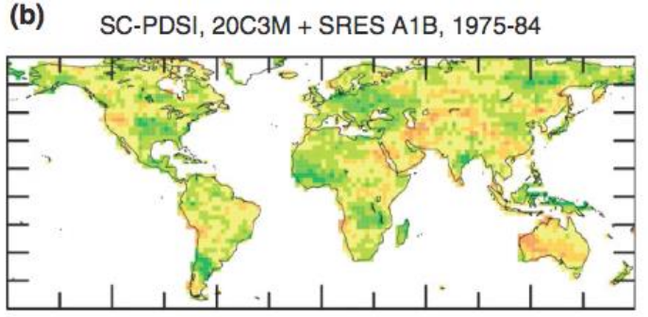


Drought index of -4 or lower is an extreme drought

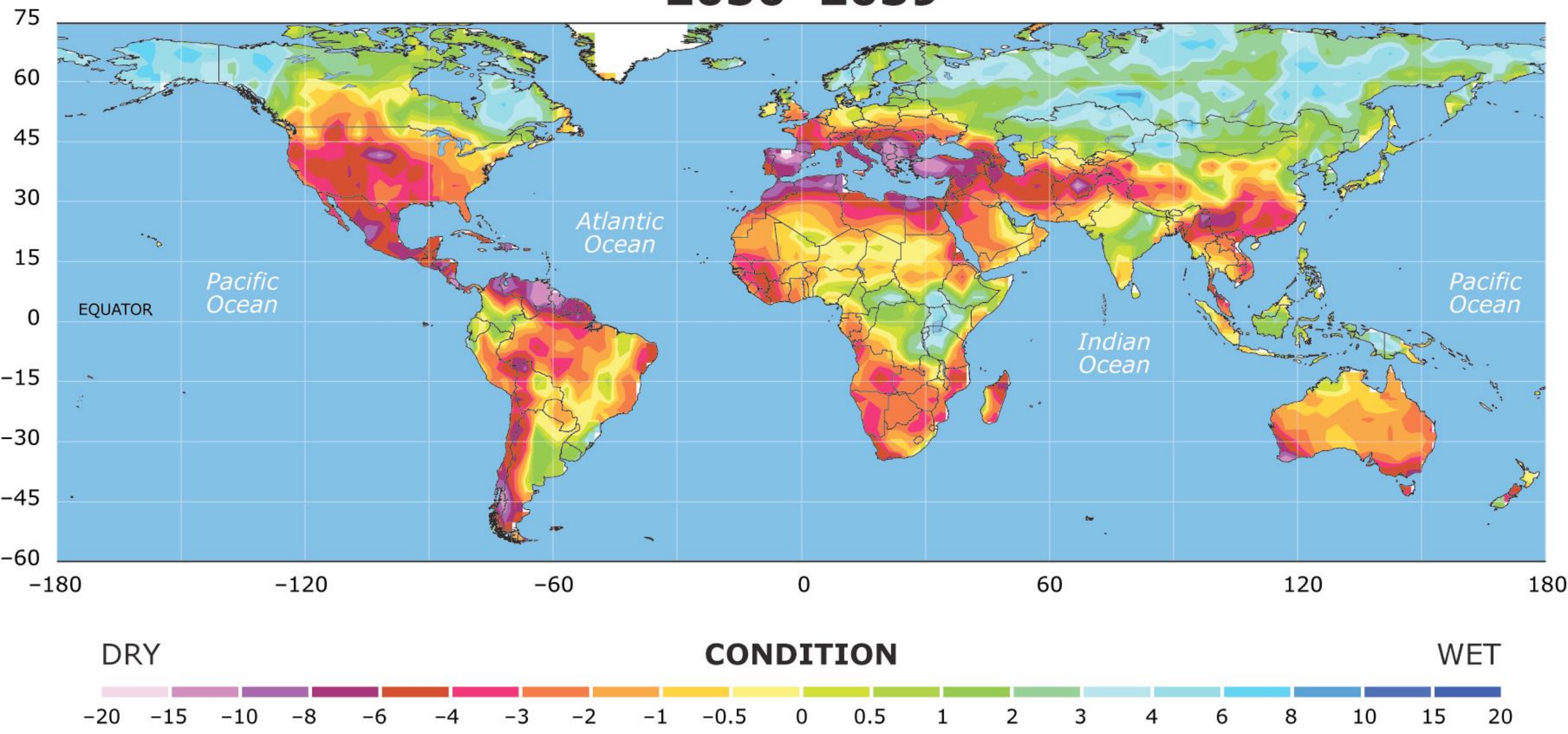
Dai 2010: *Drought under global warming: a review*, National Center for Atmospheric Research

Drying projected to continue





2030–2039



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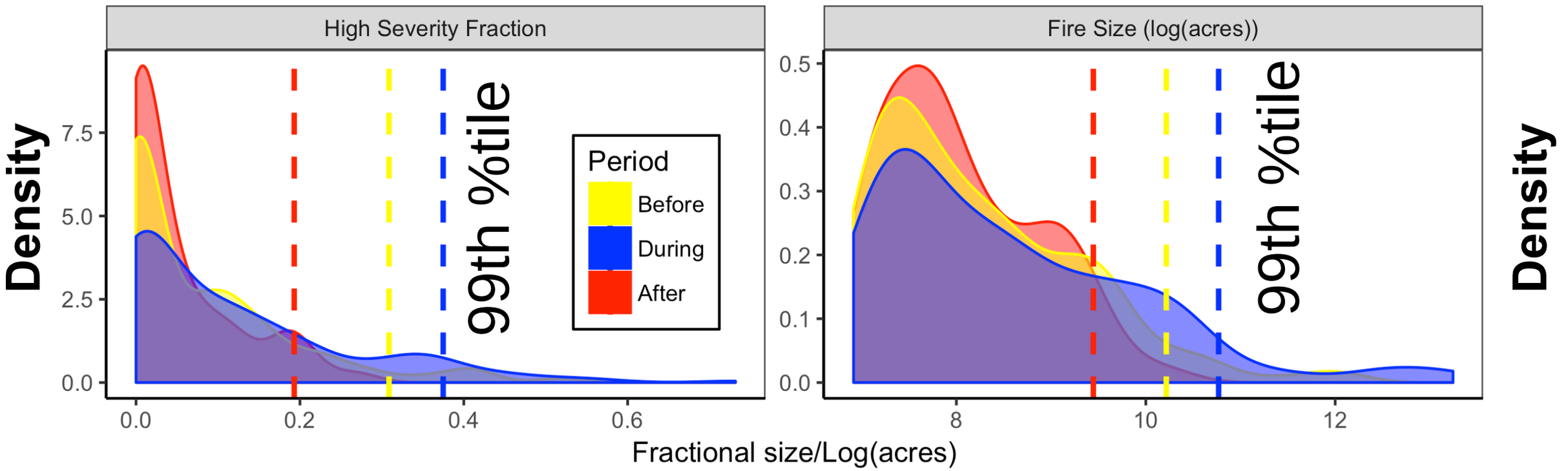
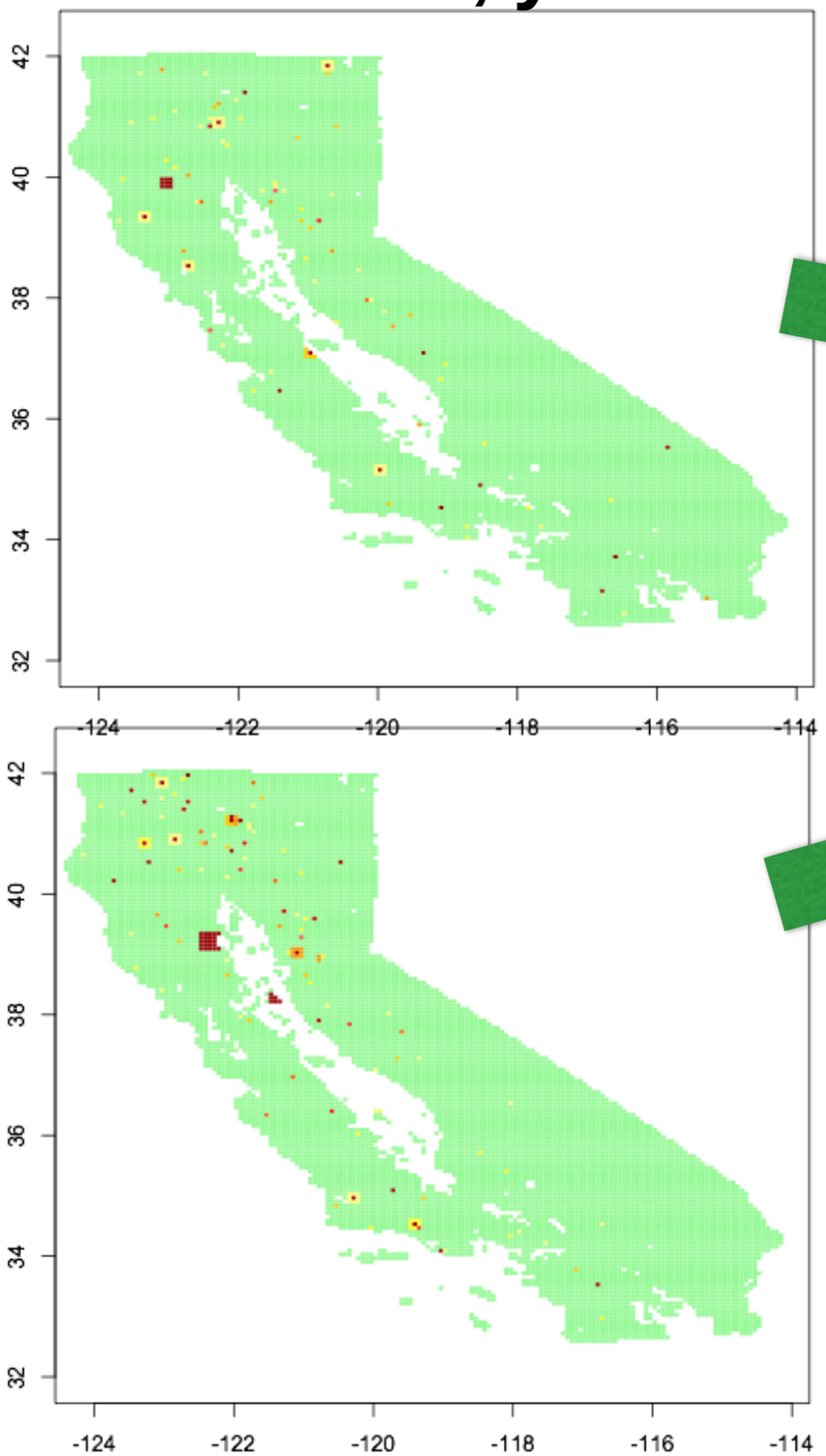
fraction and log area burned in drought affected areas: before, du

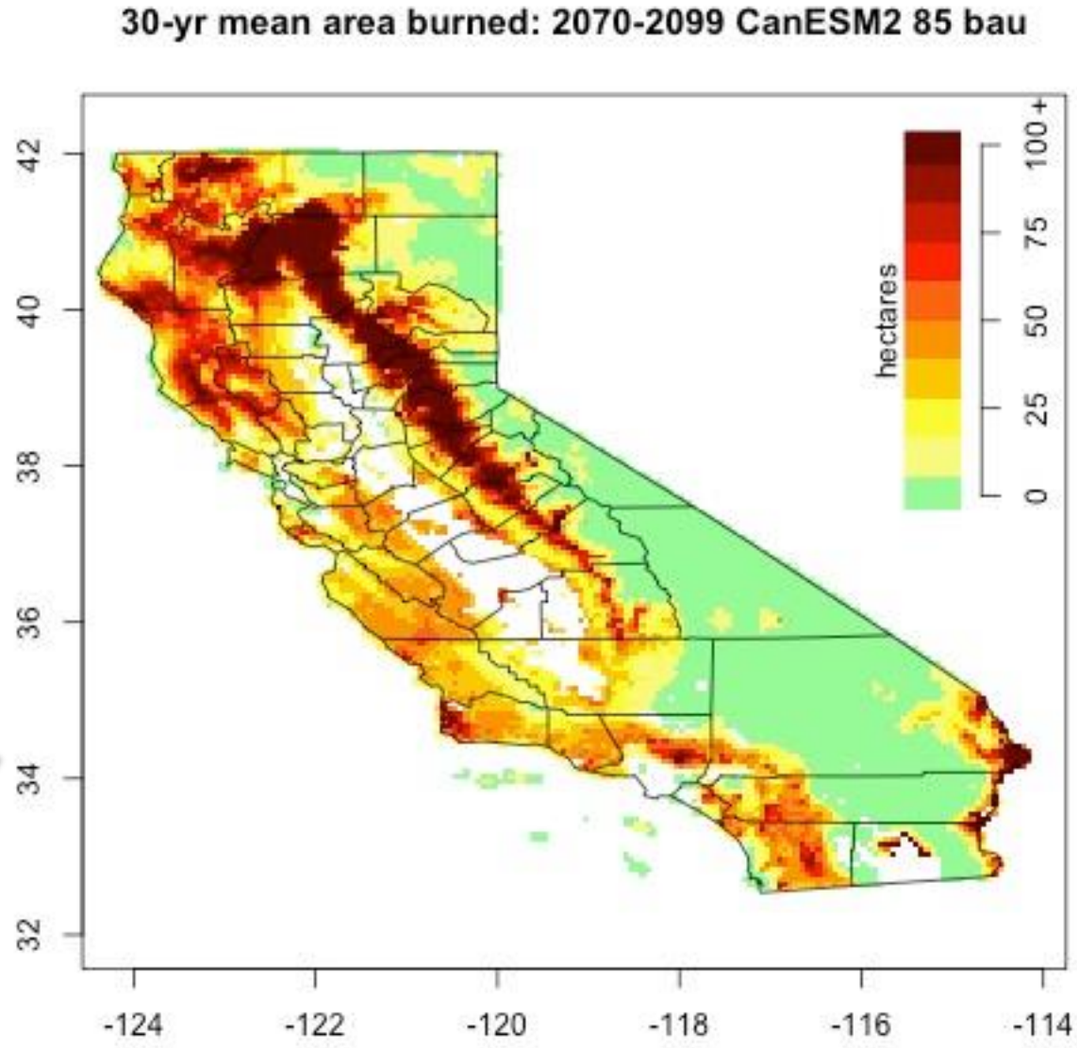


Crockett and Westerling 2018
Journal of Climate

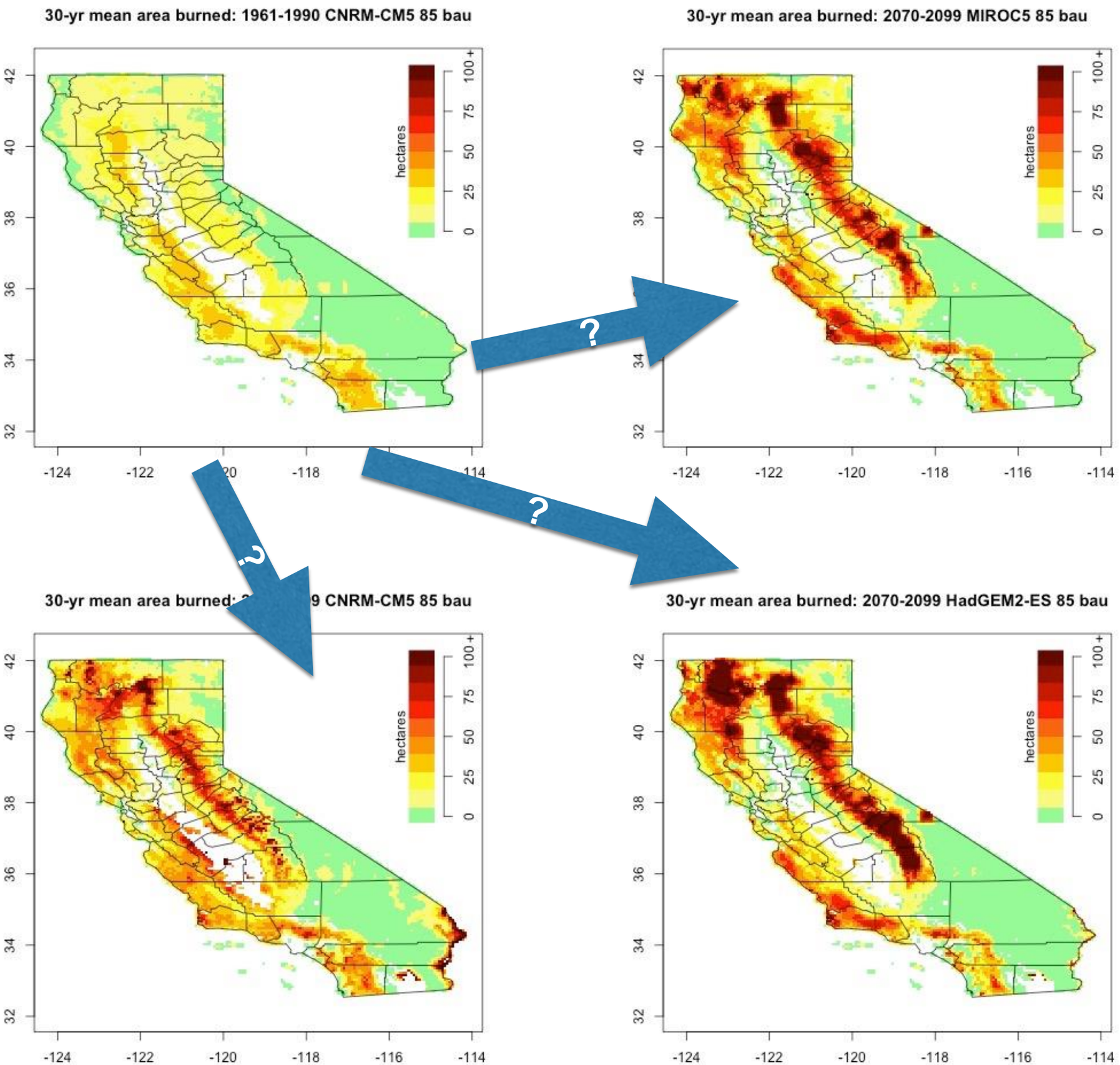
Annualized, allocated simulations multiple realizations per scenario, year



Cumulate over time, scenario(s) to obtain mean, compound distribution



Westerling *(In Review)*
Wildfire simulations for the Fourth California Climate Assessment: projecting changes in extreme wildfire events with a warming climate.


30-yr mean area burned: 1961-1990 CNRM-CM5 85 bau
30-yr mean area burned: 2070-2099 MIROC5 85 bau
30-yr mean area burned: 2070-2099 CNRM-CM5 85 bau
30-yr mean area burned: 2070-2099 HadGEM2-ES 85 bau
hectares
0
25
50
75
100 +
?
?
?
42
40
38
36
34
32
-124
-122
-120
-118
-116
-114

Takeaways

fire is increasing everywhere in the West

(more fires, larger fires, more severe fires)

California fire is increasing too

The **fire season is lengthening**…
especially in Fall in CA

Driven by a **Warming, Drying landscape** with more **variable precipitation**

California's **reality has been outpacing our projections**